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THE HEAD STRUCTURES OF THE ORTHOPTERON STENOPELMATUS—A CONTRIBUTION TO THE STUDY OF THE EXTERNAL ANATOMY OF STENOPELMATUS

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The main features of the head, thorax and abdomen of the "sand cricket" *Stenopelmatus* will be discussed in three papers dealing with the external anatomy of this extremely interesting, primitive and common insect, which is exceptionally suitable for anatomical study. The specimens used in this study were given to me by Dr. S. B. Freeborn, to whom I am deeply indebted for much valuable material.

Viewed from the front, the head capsule of *Stenopelmatus* (Fig. 5) is somewhat oval in outline, and is markedly rounded above. Its surface is quite hard and smooth, due, doubtless, to the fact that the insect uses its head and stout mandibles in digging. The huge muscle bundles inserted upon the inner surface of the skull show through the rather transparent head capsule in specimens preserved in alcohol and appear to divide the surface of the head into symmetrically arranged areas, but these have no especial value for the study of comparative morphology. The coronal suture *cs* of Fig. 5 (representing the stem of the Y-shaped epicranial suture) is rather faint, and the frontal sutures *fs* (representing the arms of the Y-shaped epicranial suture) are very indistinct; they extend just back of and above the raised area or frontal prominence above the letter *f* in Fig. 5.

The regions on each side of the coronal suture *cs* are the parietals *pa* (Fig. 5). The temples *te* or areas above and behind the eyes *e* are called the tempora. The cheeks, or regions below and behind the eyes *e* are called the genæ, *ge*. Below each gena *ge* is a sclerite *bm* variously termed the basimandibulare, mandibulare, and trochantin of the mandible. It

is demarked posteriorly by the basimandibular suture *es* which extends mesad toward its fellow on the opposite side of the head, but the two sutures do not meet in *Stenopelmatus,* as they do in some Orthoptera in which the complete suture extending across from one side to the other is called the epistomal suture. In such cases that portion of the epistomal suture between the frons *f* and the posterior clypeal region *pc* is called the frontoclypeal suture, while the lateral portions of the epistomal suture form the basimandibular sutures. In *Stenopelmatus,* the sutures, labeled *es* in Fig. 5, mark the location of the invaginations forming the anterior arms of the tentorium, labeled *pt* in Fig. 6, and since the sutures *es* correspond to the frontal pits of other insects (in which the frontal pits mark the location of the invaginations forming the anterior arms of the tentorium) they are also labeled *fp* to denote this fact. The frons, or front, labeled *f* in Fig. 5, is the area between the frontal sutures *fs* and the frontal pits *fp*. As was mentioned above, the frons is sometimes separated from the clypeus by a frontoclypeal suture (also called the clypeal suture). The clypeus is composed of two areas, the postclypeus, or epistoma *pc,* and the anteclypeus *ac*. The postclypeus *pc* is usually more darkly pigmented, and the anteclypeus *ac* is usually pale, resembling membrane in color. The suture between the clypeus and the labrum *l* is called the clypeolabral suture, or simply the labral suture. On the oral or pharyngeal surface (i. e., roof of the mouth cavity) the boundary between the labium and clypeus is marked by the tormæ described later.

The term "epicranium" is used very loosely even by recent entomologists. Thus Imms (1925) does not include the frons in the epicranial area, while Comstock (1924) states that "Under the term 'epicranium' are included all of the paired sclerites of the skull and sometimes also the front." Snodgrass (1928) includes not only the frons but also the clypeus, etc., in the designation epicranium, and there seems to be no uniformity in the application of the term. If it be employed at all, it is preferable to restrict the designation epicranium to the paired sclerites and frons, but not including the clypeus, etc. The designation vertex is also employed in various ways by different entomologists, but it is preferable to restrict its application to the upper portion of the head capsule, a vague area

on the top of the head, but not extending down the front of the face, as Yuasa (1920) and others maintain.

The faintly demarked ring about the base of the antenna (*an* of Figs. 5 and 11) is called the antennale. It bears an antennifer, *af* of Fig. 11, or projection near the base of the antenna, which is fairly large in some Orthopteroid insects, and serves as a pivotal structure for the antenna in these insects. The scape, *sc* of Fig. 11, is the large, broad, rather flat, basal segment of the antenna. The next segment or pedicel *pd* and the segment beyond it, or the postpedicel *ppd,* are subequal in size. The postpedicel *ppd* is usually regarded as the first segment of the flagellum, or that portion of the antenna distal to the pedicel *pd*. In the flagellum we may distinguish two main types of segments, the brachymeres or short segments, and the dolichomeres, or long segments. The brachymeres in turn consist of long brachymeres labeled *lb* in Fig. 11, and short brachymeres labeled *sb,* while the dolichomeres consist of broad dolichomeres *bd,* intermediate dolichomeres *id* and slender dolichomeres *sd* (at the tip of the antenna). The scape of the antenna is somewhat flattened to enable the antenna to lie close to the head, when the antennæ are laid back along the head to get them out of the way during the digging operations of the insect, and the compound eyes, *e* of Fig. 5, project slightly in their dorso-mesal region so that the antennæ can be laid back above the eyes, and may be protected to some extent by the projecting eyes (the antennæ apparently have but little freedom of movement basally, since the scape seems to move backward and forward, but has not much lateral movement, so that the eyes doubtless prevent straining the antennæ basally by furnishing some support for the scape when the latter is pressed backward during the digging operations of the insect).

The compound eyes, *e* of Fig. 5, are situated rather far down the sides of the head, and they are not very large. Our eastern "cave cricket," *Ceuthophilus,* exhibits a similar tendency toward the reduction of the compound eyes, and even *Grylloblatta,* which is very like the ancestors of all of these forms, has very small eyes (see Crampton, 1926). The hiding habits of these insects doubtless put a premium upon relatively small eyes and correspondingly well developed antennæ, and in insects with hiding habits we frequently find the development of sen-

sitive antennæ correlated with a reduction of the eyes, enabling those forms which exhibit this tendency to establish themselves in caves and similar situations more readily than other types of insects. The reduction of the eyes is thus due not so much to "disuse," as it is to the fact that antennal development (useful in the dark) is correlated with eye reduction. The ocelli are vestigial or lacking (what appear to be very faint traces of them can be barely made out) and in this respect *Stenopelmatus* likewise resembles *Ceuthophilus* and *Grylloblatta.*

When the head is removed and is viewed from the rear, as in Figs. 13 and 6, one may readily observe a large posterior opening called the occipital foramen, or foramen magnum, *ocf,* through which the gullet, nerve cord, etc., pass backward from the head capsule into the neck and prothoracic region. On each side of the foramen is a lateral sclerite *po,* or paroccipu t, which is considered by Riley (1904) to be the pleural region of the labial segment. It is separated by a rather pronounced groove, the paroccipital groove, from the rest of the head capsule; and at the ventral end of the groove is located the gular pit, *gp* of Figs. 6 and 12, which is formed by an invagination or inpushing of the chitin to form a posterior arm of the tentorium presently to be described. Ventral to the gular pit, *gp* of Fig. 12, is a paragular process, *pap,* over which a basal projection of the maxillary cardo rides (i. e., the projection labeled *d* in Figs. 13, 10, etc.). The sclerite *po* bears an occipital condyle, *occ* of Figs. 13 and 6, for articulation with the anterior end of the lateral cervical or neck plate. The endocciput, *eo* of Fig. 13, is an internal ridge formed by an infolding of the integument between the sclerite *po* and the cranium proper. A dorsal paroccipital tendon *pat* is attached near its dorsal portion, and is a tendon of muscles extending to the thoracic region. The sclerite, *eoc* of Fig. 13, is a demarked median dorsal region called the euocciput or surocciput, and near its anterior margin (internally) is attached a median dorsal tendon *eot* of a muscle extending to the thoracic region. The sclerites *po* and *eoc* are parts of the occiput, or occipital region of the head.

Lateral to the paroccipu t, *po* of Figs. 13, 6, 12, etc., is the postgena *pge* which is separated from the gena *ge* by the postgenal suture *pgs.* Ventrally, there is demarked in the postgenal

region a marginal area, the parastome or hypostoma *pst,* extending along the ventral edge of the posterior region of the head capsule. This marginal area *pst* bordering the mouth region posterolaterally is rather illy defined in *Stenopelmatus,* but in certain beetles it forms an important sclerite. In this general region are the projections *pap* of Fig. 12, over which the process *d* of the cardo rides (Fig. 10), and the projection *pp* (Figs. 13 and 3), which bears a cup-like acetabulum *pga* (Fig. 3) for the posterior condyle of the mandible *h.*

The mandible has three principal surfaces best noted when the mandible is removed and viewed basally (i. e., looking down into its hollow interior), as in Fig. 2. The outer or lateral surface bears a lateral prominence *ep* to which is attached the extensor tendon *et* of the muscle opening the mandible, and the outer surface (in section) forms the base of a triangle at the apex of which is the mesally located structure *gn* of Fig. 2, bearing the flexor tendon *ft* of the muscles closing the mandible. The ginglymus *g* (Fig. 2) is an anterior projection presently to be described, and the condyle *h* is a posterior projection which will be discussed later. From *g* to *gn* in Fig. 2 is the anterior surface, and from *h* to *gn* is the posterior surface, and *gn* is located at the base of the median ridge of the mandible, best shown in Fig. 4. The endognath *eg* of Fig. 2 is a basal internal shelf projecting inward and extending around the basal portion of the mandible.

In Fig. 4 is shown a posterior view of the insect's left (sinistral) mandible; and seen in this view, the mandible appears to taper distally (ventrally) to form the gnathapex *ga.* Dorsal to this region, along the median ridge of the mandible, is the grinding area or mola *m* of Fig. 4; and dorsal to the mola is the brush or brustia *br.* At the base of the median ridge of the mandible is the gnathite *gn,* which bears the flexor (closing) tendon *ft* (compare *gn* and *ft* of Fig. 2). On the opposite or outer surface of the mandible is the projection *ep* bearing the extensor (opening) tendon *et,* behind which is the condyle *h* (compare also *ep* and *h* of Fig. 2). On the posterior surface of the mandible is the gnathal impress *gs* of Fig. 4, or depression marking the position of an internal projection for muscle attachment, etc.

If the basal region of the mandible shown in Fig. 2 is turned back up in the normal position, as shown in Fig. 3, it will be seen that the posterior condyle *h* fits into an acetabulum *pga* borne on the process labeled *pp* in Figs. 3, 1, and 13; and the anterior ginglymus *g* of Figs. 2, 3, etc., is received into a niche or incision in the lateral margin of the postclypeus *pc* as is shown in Figs. 3 and 1, where the incision is labeled *ct*. The ginglymus *g* of Figs. 2 and 3 is likewise grooved, and fits over a ridge (clypeothecal ridge) near the incision *ct* which receives the projecting ginglymus, *g*. The epignath, or lateral prominence *ep* of the mandible (see Fig. 2), dips beneath the basimandibular sclerite *bm* of Fig. 1, when the mandible is opened (see also Fig. 5) and its tendon *et* extends dorsad on the mesal side of the anterior arm of the tentorium labeled *pt* in Fig. 3. If a line is drawn between the points labeled *g* and *h* in Fig. 2, it will be seen that the point of attachment of the extensor tendon *et* borne on the prominence *ep,* lies outside of, or lateral to this line between *g* and *h* (compare Fig. 4), so that when the mandible rocks or pivots on the points *g* and *h,* a pull exerted at the point *ep* of Fig. 2 would open the mandible; and since the muscle opening the mandible need not be very powerful, the tendon attached at this point is a slender one. When the mandible pivots on the points *g* and *h* of Fig. 2, and a pull is exerted at the point *gn,* the mandible would be closed; and since the closing muscles must be very powerful for chewing food, etc., the flexor tendon *ft* exerting a pull at *gn* is a hugely developed tendon (see also Fig. 4). As is shown in Fig. 4, the flexor tendon *ft* is not attached directly to the mandible itself, but is borne on a sclerite-like structure, the gnathite *gn,* which is itself attached to the mandible by a membrane.

In describing the parts of the maxilla, I have employed the terminology used in a paper in which the maxillæ were compared throughout all of the orders of insects (Crampton, 1923); and I would again call attention to the homologies pointed out in this paper, since the facts brought out in the article in question are completely ignored by recent entomologists who misinterpret the basal region of the stipes for the entire stipes in the Coleoptera, and misidentify the parastipes of Orthopteroid insects with the so-called subgalea described by coleopterists who mistook the inflexed edges of underlying sclerites for

sutures in the plates situated above them in balsam mounts of maxillæ, and applied the designation subgalea to a supposed area situated below the galea (or in reality dorsal to the galea) wholly different from the parastipes here described. Since there is not space here for a full discussion of the parts in different insects, the reader is referred to the above-mentioned article for a comparison of the parts in different insects, and the reasons for the views concerning the homologies here accepted.

In Fig. 13 is shown a posterior view of the insect's right or dextral maxilla. The basimaxillary membrane, labeled *b,* connects the maxilla with the labium (and with the hypopharyngeal region). The basal segment or cardo is divided by the cardinal suture, *cds* of Figs. 10 and 13, into a basicardo *bc* and disticardo *dc*. An internal ridge or endocardo, *ec* of Fig. 8, corresponding to the external cardinal suture, extends along the inner face of the cardo and serves to strengthen the cardo and likewise offers a point of attachment to certain of the muscles inserted upon the inner surface of the cardo. The cardoprocess, *cp* of Figs. 8 and 10, is an inner process to which the cardo tendon *ctn* is attached. This tendon enables the extensor or opening muscles of the maxilla to exert a pull at the point *cp,* while the region under the process, labeled *d* in Fig. 10, serves as a fulcrum or pivotal point in opening the maxilla. The process, labeled *d* in Figs. 10 and 8, rides over the ridge *pap* of Fig 12, while the process *cp* lies on the inner side of the ridge *pap,* so that the process *cp* of Fig. 10 is not visible from the exterior, while the process *d* of Fig. 10 is visible from the exterior, as is shown in Fig. 13.

The endostipes *est* of Fig. 8 is an internal ridge which serves to strengthen the walls of the stipes, and furnishes attachment for certain of the muscles which serve to close the maxilla, or to draw it toward the labium. The endostipes *est* of Fig. 8 corresponds to the external parastipital suture which demarks the parastipes *ps* of Fig. 13. The parastipes *ps* is not homologous with the so-called subgalea, although MacGillivray and others have mistakenly supposed that these two sclerites are the same. In many Coleoptera, Dermaptera, certain Gryllotalpids, etc., the stipes *s* of Fig. 13 is divided into a basal region and a distal region *ds,* but in *Stenopelmatus* the basal region is not demarked, although the distal region *ds* is faintly

demarked by a somewhat indistinct suture. The region *ds* is external to the point of attachment of the laciniatendon *lt* of Fig. 8, or the internal tendon attached to the base of the lacinia *la*. When this tendon exerts a pull upon the lacinia the lacinia apparently pivots upon the end of the endostipital ridge *est* of Fig. 8, although the lacinia does not seem to be very mobile. An anterior view of the lacinia is shown in Fig. 9, in which the tooth-like processes of the lacinia are labeled *ld,* the lacinia-mobilis-like process is labeled *lii,* and the lacinial fringe is labeled *gf*. The basigalea *bg* and distigalea *dg,* or basal and distal segments of the galea, are more clearly demarked in the anterior region shown in Fig. 9 than in the posterior region shown in Fig. 13. The palpifer *pf* of Fig. 13 is fairly clearly demarked, and the maxillary palpus *mp* which it bears is composed of the five segments typical of lower insects. The fifth segment bears a sensory area which is stippled in Fig. 13.

The labium is shown in Fig. 13. The glossæ *gl* are fairly well developed, and the glossæ with the paraglossæ *pgl* are borne on the glossigers *gg,* which in turn are borne at the distal ends of the sclerites *li,* which represent the labial stipites, while the glossæ and paraglossæ represent the laciniæ and galæ of the labium. Basolaterad of the sclerites *li* are the palpigers *pg,* which correspond to the maxillary palpifers and bear the palpi *lp* which are reduced to three segments in the labium of Orthopteroid insects. The sclerites representing the maxillary cardines are vestigial, although some investigators maintain that the mentum *mn* represents the united cardines, while others think that the cardines are represented by the submental region. The mentum *mn* is distinct and quite well developed in *Stenopelmatus,* and is somewhat suggestive of the mentum of a cricket. The submentum *sm* and gula *gu,* though differing in color, are merely regions of a single plate in most Orthopteroid insects, and the gula *gu* is not united with the head capsule in *Stenopelmatus,* although the gular pits *gp* of Fig. 12 are situated near the gula *gu*. The gular pits *gp* are the mouths of the invaginations forming the posterior arms of the tentorium presently to be described. The postgular plate *pgu* of Fig. 13 is a ventral cervical plate, which will be described in discussing the neck region of *Stenopelmatus*.

In Fig. 6 the labium has been removed and the parts of the tentorium are shown as though cleared of the muscles and other concealing structures, which were removed by boiling in 10 per cent caustic potash. The gular pits, which were mentioned above, are labeled *gp* in Fig. 6. The invaginations from the gular pits form the posterior arms of the tentorium, which unite to form the eutentorium or body of the tentorium, labeled *eu* in Fig. 6, and they also form the posterior arch, labeled *p* in Fig. 6. Behind the arch *p* are the two posterior processes, labeled *pop,* which bear the posttentorial tendons, labeled *pot.* A deep emargination or incision, labeled *nf* in Fig. 6, forms the neural incision, which apparently corresponds to the neuroforamen of the roach, etc. (see description by Crampton, 1925). The anterior arms of the tentorium, labeled *pt* in Fig. 6, extend backward from the frontal pits, *fp* of Fig. 5, and give off the dorsal arms of the tentorium, labeled *st* in Fig. 6. At the distal ends of the structures, labeled *st,* are borne the delicate structures, labeled *dt* in Fig. 6, which are apparently distal portions of the dorsal arms of the tentorium.

The hypopharynx *hp* is shown in Fig. 15. The hypopharynx of *Stenopelmatus,* like that of the roach figured by Crampton (1925), is composed of a distal region *dl,* or distilingua, and a basal region *bl,* or basilingua. The salivary glands, which are not shown in Fig. 15, open in the ventrobasal region of the basilingua, *bl.* The slender sclerite, labeled *ll* in Fig. 15, apparently corresponds to the sclerite called the lingualora in the roach, and the sclerite, labeled *pl,* corresponds to that called the linguatendon in the roach. Since the sclerite *pl* is not exactly a tendon, it is preferable to refer to it as the postlingua in *Stenopelmatus.* The dorsal portion of the base of the hypopharynx, labeled *sl* in Fig. 15, lies below the posterior epipharyngeal region, labeled *poe* in Fig. 15.

The regions labeled *poe* and *pre* in Fig. 15 are the posterior and anterior regions of the epipharynx or portion of the roof of the mouth. The posterior region *poe* is situated in the clypeal area, while the anterior region *pre* is situated in the labral area. In Fig. 7 these areas of the epipharynx are shown in an inner or buccal (pharyngeal) view of the labrum and clypeal region. The tormæ *to* of Fig. 7 demark the labrum from the

clypeus in this view. A narrow transverse sclerite *it* extends between the tormæ *to* and serves to demark the anterior epipharyngeal region *pre* from the posterior epipharyngeal region *poe*.

In discussing the relation of the maxilla to the underlip, it should have been mentioned that the distal margin of the maxillary membrane *b* merges into the distal margin of the submentum *sm,* as shown in Fig. 13. The attachment of the basimaxillary membrane *b* may therefore be taken as a landmark for demarking the distal limits of the submentum in *Stenopelmatus* and certain other insects. In higher insects, however, this criterion for determining the distal limits of the submental region does not hold good, so that this feature is not of universal application (see discussion by Crampton, 1928).

The external anatomy of the thoracic and abdominal regions will be discussed in another paper, since it is possible to devote more space to the description of the parts, and more plates to illustrating the anatomical details of the various regions, if these are treated in a series of papers, instead of trying to include the descriptions of all of the main external features of *Stenopelmatus* in a single paper.

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Abbreviations

ac. Anteclypeus
af. Antennifer
an. Antennale
ant. Antenna
b. Basimaxillary membrane
bc. Basicardo
bd. Broad dolichomeres of antenna
bg. Basigalea
bgl. Basiglossa
bl. Basilingua
bm. Basimandibulare
bmm. Basimandibular membrane
br. Brustia
bs. Basiscape
c. Clypeus.
cds. Cardosuture
cp. Cardoprocess
cs. Coronal suture
ct. Clypeotheca
ctn. Cardotendon
d. Epicardo
dc. Disticardo
dg. Distigalea
dl. Distilingua
ds. Dististipes
dt. Distitentorium
e. Compound eye
ec. Endocardo
eg. Endognath
eo. Endocciput
eoc. Euocciput or surocciput
eot. Euoccipital tendon
ep. Epignath or extensor prominence
es. Epistomal suture
esp. Endostipital process
est. Endostipes
et. Extensor tendon
eu. Eutentorium or body of tentorium
f. Frons or front
fp. Frontal pits or clefts
fs. Frontal sutures
ft. Flexor tendon
g. Ginglymus
ga. Gnathapex
ge. Gena
gf. Laciniafimbrium
gg. Glossiger (basiglossa)
gl. Glossa
gn. Gnathite
gp. Gular pits.
gs. Gnathal suture or impress
gu. Gula
h. Gnathocondyle or hypocondyle

hp. Hypopharynx
id. Intermediate dolichomeres of antenna
it. Intertorma
l. Labrum
la. Lacinia
lb. Long brachymeres of antenna
ld. Laciniadentes
li. Labiites or labial stipites
lii. Lacinula
ll. Lingualora
lp. Labial palpus
lt. Laciniatendon
m. Mola
md. Mandible
mn. Mentum
mp. Maxillary palpus
nf. Neuroforamen or neural incision
occ. Occipital condyles
ocf. Occipital foramen or foramen magnum
p. Tentorial arch or trabecula
pa. Parietalia
pap. Paragular or paroccipital process
pat. Paroccipital tendons
pc. Postclypeus or epistoma
pd. Pedicel
pf. Palpifer
pg. Palpiger
pga. Postgenal acetabulum
pge. Postgenæ
pgl. Paraglossæ
pgs. Postgenal suture
pgt. Paraglossal tendon
pgu. Postgulare
pl. Postlingua or "linguatendon"
po. Parocciput
poe. Postepipharynx
pop. Posttentorial process
pot. Posttentorial tendon
pp. Postgenal process
ppd. Postpedicel
pre. Preepipharynx
ps. Parastipes
pss. Parastipital suture
pst. Parastomium
pt. Pretentorium
s. Stipes.
sb. Short brachymeres of antenna
sc. Scape
sd. Slender dolichomeres of antenna
sl. Dorsolingua (surlingua)
st. Supratentorium
te. Tempora
to. Tormæ

Explanation of Plates

Fig. 1—Lateral view of sinistral mandible, clypeus and labrum; Fig. 2—Dorsal view of base of sinistral mandible; Fig. 3—Lateral view of base of mandible and neighboring parts; Fig. 4—Posterior view of sinistral mandible; Fig. 5—Frontal view of head; Fig. 6—Posterior view of tentorium and neighboring parts; Fig. 7—Inner or buccal view of labrum and clypeus; Fig. 8—Inner surface of cardo and stipes; Fig. 9—Anterior view of lacinia and galea; Fig. 10—Basal portion of dextral maxilla (posterior view); Fig. 11—Parts of antenna; Fig. 12—Posterior view of region at base of gular plate; Fig. 13—Posterior view of back of head; Fig. 14—Anterior view of glossæ and paraglossæ; Fig 15—Lateral view of hypopharynx and upper and lower lip, with most of the head capsule removed.

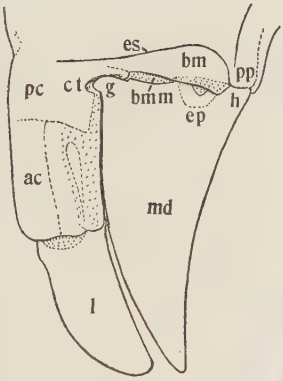


Fig. 1

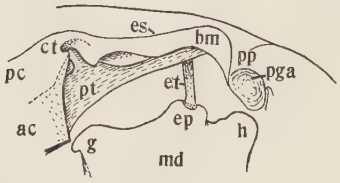


Fig. 3

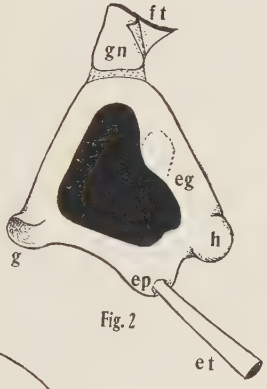


Fig. 2

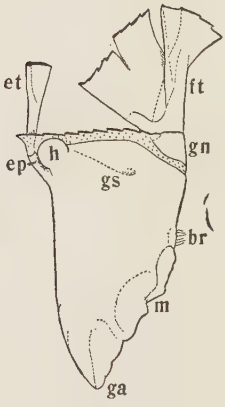


Fig. 4

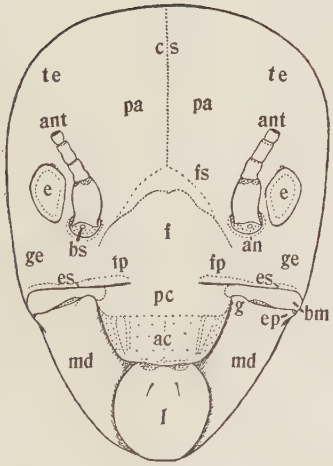


Fig. 5

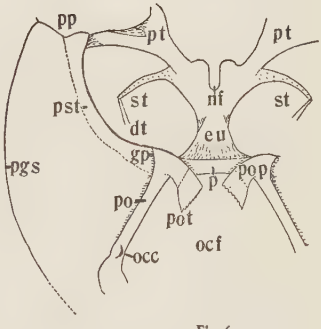
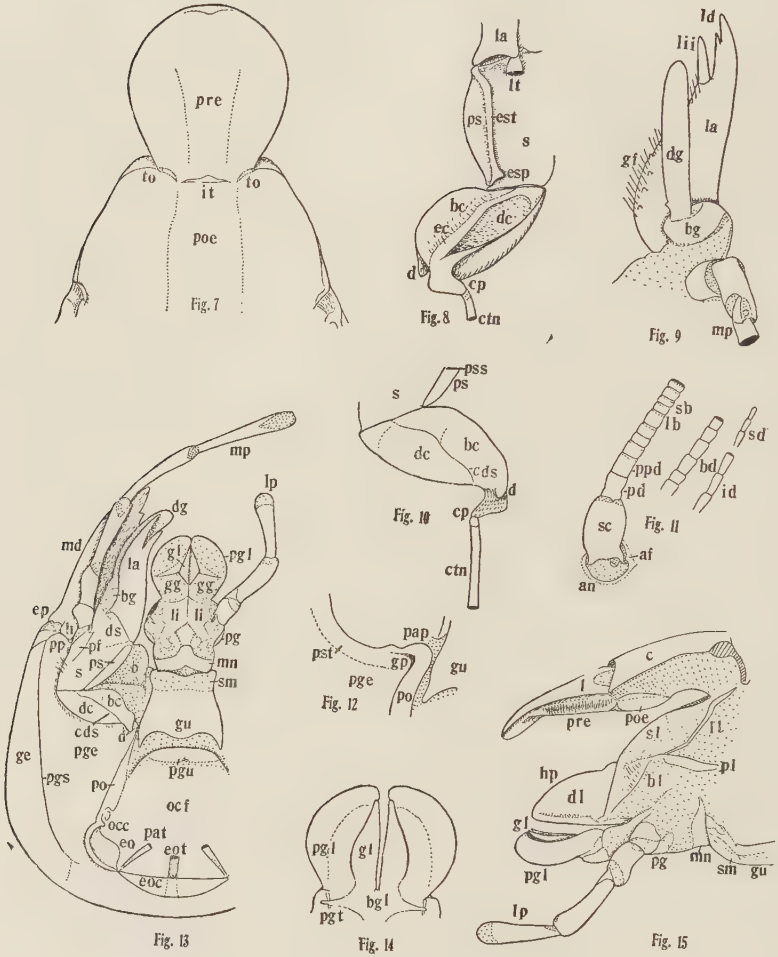


Fig. 6

Crampton. Head structures of Stenopelmatus. For explanation see page 108.



Crampton. Head structures of Stenopelmatus. For explanation see page 108.

ON SOME CENTIPEDS AND MILLIPEDS FROM UTAH AND ARIZONA

BY RALPH V. CHAMBERLIN
University of Utah

These notes are based chiefly upon material collected in the course of a field trip from the Department of Zoölogy of the University of Utah to the western side of the Henry Mountains during September, 1929. Collections were made *en route* at several points, such as at Fish Lake, in Sevier County, and at the Neff ranch in Horse Valley, Wayne County. A few forms from other localities, such as Flagstaff and the Kaibab Forest, Arizona, and St. George, Utah, are also included.

CHILOPODA

LAMYCTES FULVICORNIS Meinert

Utah: Capitol Wash, Wayne County. One specimen 9 mm. long was taken by W. Gertsch on September 12.

The specimen lacks the anal legs, but agrees so closely in other features that little doubt can exist as to its identity.

OABIUS PIUTUS Chamberlin

Utah: Horse Valley, Wayne County. One male.

This species was taken originally at Parowan in Iron County.

POKABIUS UTAHENSIS (Chamberlin)

Utah: Fish Lake, Sevier County (September 4 and 5); Butterfield Canyon, Salt Lake County (May, 1929).

This species is abundant at both these places under fallen leaves, etc., along the stream courses. It is one of the commonest chilopods in the state.

Pokabius piedus Chamberlin, new species

A species of Pokabius sens. str. which resembles *P. utahensis* in having only the last pair of coxæ laterally armed. It is a larger form most readily distinguished in the male by the form of the anal legs. In these the fourth joint is widely longitudinally furrowed above with the mesal side of this furrow limited by a ridge which at its proximal end is produced dorsomesad into a process much as in *P. gilæ*, but the process is longer and distally narrower. Unlike *P. utahensis* and *P. gilæ* the third joint is not produced at its distal end opposite to or continuously with the process of the fourth joint. Anal legs with dorsal spines 1, 0, 3, 1, 0; ventral spines,

0, 1, 3, 2, 0; coxa also laterally armed. Penult legs with dorsal spines 1, 0, 2, 1, 1; ventral spines, 0, 1, 3, 3, 2, with three claws. Coxal pores, 2, 2, 2, 2. Ocelli few, in two series; e. g., 1 + 4, 3, the single ocellus close to the others.

Color of dorsum light brown, the last tergite and the frontal region of head lighter; legs and antennæ yellow.

Length, 11.5 mm. (male holotype).

Utah: St. George, Washington County. One male taken April 3, 1929, by Lowell Woodbury.

LOPHOBIUS FRANCISCÆ Chamberlin

Utah: Fish Lake and Burrville, Sevier County (September 5 and 6); Panguich, Garfield County (A. M. Myers collection); Henry Mountains, Wayne and Garfield counties.

This species seems to be abundant at all these places. In the specimens from Fish Lake it was noted that the ventral spines of the anal legs are either 0, 1, 3, 2, 1 or 0, 1, 3, 2, 0, the latter formula being more frequent than in the type specimens from Cedar City. It is plentiful in the Henry Mountains, above King's ranch, at the level of the yellow pines (e. g., at Pine Springs).

LOPHOBIUS COLLIUM Chamberlin

Utah: Fish Lake (September 5), and Fruita (September 14), Wayne County; Horse Valley and near Loa (September 6), Wayne County; Henry Mountains, especially at level of the quaking aspens (September 10 and 11), Garfield County. Abundant at all these places.

This species is common from Salt Lake County southward as far as Bluff, San Juan County, especially under stones over the open foothills and other nonwooded places.

ANOBIUS CENTURIO (Chamberlin)

Utah: Henry Mountains, at King's ranch, base of mountains. Common. Previously reported from San Juan County, Utah, and New Mexico (type locality).

BOTHROPOLYS PERMUNDUS Chamberlin

Utah: Butterfield Canyon, Salt Lake County. Found common in May, 1929.

Common in canyons of the Wasatch Mountains, especially in the northern part of the state. It seems to be replaced

farther south, as in Wayne County, by the next species, *Archethopolys parowanus.*

ARCHETHOPOLYS PAROWANUS Chamberlin

Utah: Fish Lake, Sevier County; Henry Mountains, at several localities (e. g., Pine Springs, Willow Springs, and other points above King's ranch).

Apparently common in favorable places in Wayne and Garfield counties, where it is undoubtedly the prevalent large lithobioid.

Archethopolys kaibabus Chamberlin, new species

A species closely related to *A. gosobius* occurring in San Juan County, but much smaller in size and typically with only a single prosternal tooth ectad of the diastemal seta instead of three or four, the dental formula in the holotype being 1-6 + 6-1. In thus having but a single tooth ectad of the diastema the species agrees with *A. parowanus,* but the latter species has the claw of the genital forceps of the female entire, whereas in the present species the claw is tripartite, with the basal spines 3 + 3. Last two pairs of coxæ armed ventrally and laterally. Ventral spines of anal legs, 1, 1, 3, 3, 2, the claw armed with two straight spines at base. Ocelli in a narrowly elongate patch, arranged in three series; thus, 1 + 6, 5, 2. Antennæ consisting of twenty articles, moderate in length, reaching upon the sixth dorsal plate.

Length, 18 mm., or a little less.

Arizona: Kaibab Forest, not far from the Utah border. One female (holotype) and a male lacking anal legs, collected by Lowell Woodbury on July 7, 1929.

The species of this group (Archethopolys) now known from Utah and the adjacent parts of Arizona may be separated by means of the following key.

a. Normally with two or more teeth ectad of diastemal bristle on the prosternal margin.
   b. Ventral spines of anal legs, 1, 1, 3, 2, 1; ectal teeth of prosternum on each side, normally, two..... *A. bipunctatus* (Wood)
   bb. Ventral spines of anal legs, 1, 1, 3, 2, 0; ectal teeth on each side of prosternum, normally, three or four..... *A. gosobius* Chamberlin

aa. Normally with only one tooth ectad of diastemal bristle on each side of prosternum.
   b. Claw of genital forceps of female entire, acute; length, 21 mm. and above..... *A. parowanus* Chamberlin
   bb. Claw of genital forceps of female more blunt, tripartite; length, 18 mm..... *A. kaibabus,* new species

LINOTÆNIA CHIONOPHILA (Wood)

Mill Creek Canyon, Salt Lake County (August, 1929); Butterfield Canyon, Salt Lake County (May, 1929); Fruita, Wayne County; Henry Mountains, Garfield County (e. g., at Willow Springs and Pine Springs, September 10 and 11, 1929).

This species, common in Canada, Alaska, etc., is distributed throughout Utah in the mountains, especially at middle and upper elevations.

GEOPHILUS GLYPTUS Chamberlin

Utah: Butterfield Canyon, Oquirrh Mountains, Salt Lake County (May, 1929).

This species was described originally from the Wasatch Mountains, Salt Lake County, and is also known from the State of Washington.

Geophilus piedus Chamberlin, new species

A species resembling *G. rubens* Say in having the frontal plate discrete, the prebasal plate exposed, the last ventral plate very wide, with two pits on each anal coxa covered by the last ventral plate. It differs from that species, among other points, in having the spiracles, excepting the last few, elliptic in shape instead of circular, with the first two on each side much larger than the third, the second not being much smaller than the first; in having the ventral pores in a band along caudal border of plate strongly developed, this band extending forward angularly at middle line; and in having the number of pairs of legs much greater, seventy-nine in the holotype. Dorsum lacking the geminate dark band showing typically in *G. rubens*.

Length, 75 mm.

Utah: St. George. One male taken by Lowell Woodbury, April 3, 1929.

GEOPHILUS FRUITANUS Chamberlin

Utah: Horse Valley, Wayne County. One female.

Like the holotype, which was taken at Fruita, Wayne County, in May, 1928, the present specimen has fifty-seven pairs of legs.

GNATHOMERIUM XENOPORUS (Chamberlin)

Utah: Butterfield Canyon (May, 1929), and Mill Creek Canyon (August, 1929), Salt Lake County; Fish Lake and Burrville (September 4 and 6), Sevier County; Horse Valley (September), and Fruita, Wayne County; Panguich (A. M. Myers) and Henry Mountains (Willow Springs, Pine Springs

and at level of quaking aspens, September 10 and 11), Garfield County.

This species in Salt Lake County and other northern sections of the state on the average has fewer pairs of legs (forty-five to forty-nine) than those represented by the present collection from more southern localities. In the latter the pairs of legs range from forty-nine to fifty-three.

Navajona Chamberlin, new genus

Frontal suture absent. Prebasal plate covered. Dorsal plates bisulcate. Antennæ short and filiform. A single clypeal area present, this small and finely areolated. Labrum free, with the lateral pieces meeting at the middle line, fringed throughout with long spinescent processes. Outer branch of first maxillæ distinctly biarticulate, each bearing two membranous lappets of which the distal one, in the holotype, is the larger. Inner branch undivided, set off by a suture which may be in part indistinct. Coxæ completely fused. Coxæ of the second maxillæ weakly united at middle by a more membranous isthmus; pleurosternal sutures strongly developed; the pore opening mesad of anterior end of suture through edge of sclerite; palpus triarticulate, terminating in a simple claw, none of the joints with processes.

Prehensors large, exposed at sides and projecting beyond front margin of the head. Claw armed at base; femuroid armed distally and the intermediate joints armed with weaker teeth or bosses. Prosternum without chitinous lines; anterior margin unarmed. Ventral pores absent. Anterior spiracles elliptic. Last ventral plate wide. Coxopleuræ but little inflated. Pores small and few in number. Anal pores well developed. Anal legs clawless, consisting of only five joints distad of coxæ.

Genotype. *Navajona miuropus,* new species.

This genus differs from all other chilenophiloid genera in having only five articles in the anal legs distad of the coxæ. It may be placed with reference to the other known North American genera of the group by means of the following key.

Key to North American Genera of the Chilenophilidæ

a. Anal legs with an additional article replacing the claw.
  b. Coxæ of second maxillæ broadly and completely fused ..... *Telocricus* Chamberlin
  bb. Coxæ of second maxillæ separated or at most weakly united by a membranous isthmus..... *Watophilus* Chamberlin

aa. Anal legs without such additional article, having only five or six articles beyond coxopleuræ; either with or without claws.

b. Lateral pieces of labrum overlapping the median piece and meeting at middle line.
  c. Anal legs with six articles beyond coxopleuræ and bearing claws.
    d. No clypeal area present.....*Gnathomerium* Ribaut
    dd. A clypeal area present.....*Cryophilus* Chamberlin
  cc. Anal legs with only five articles beyond coxopleura, clawless.....*Navajona,* new genus
bb. Lateral pieces of labrum not in contact at median line, more or less widely separated by middle piece.
  c. No ventral pores present.....*Taiyuna* Chamberlin
  cc. Ventral pores in four areas.....*Nesidiphilus* Chamberlin

Navajona miuropus Chamberlin new species

Body yellowish. Cephalic plate longer than wide nearly in ratio 3:2, a little wider anteriorly than posteriorly; lateral margins at middle nearly straight, but the corners well rounded (see figure); anterior margin somewhat arcuate; caudal margin nearly straight or very slightly convex. Basal plate a little overlapped anteriorly by the cephalic, its exposed area wider than long in the ratio 2.25:1.

Claws of prehensors when closed attaining anterior end of first antennal article. Claw armed at base with a tooth of moderate size. Femuroid armed near distal end with a rounded, somewhat distally directed, tooth. The intermediate joints each with a small, rounded nodular tooth or boss. Anterior margin of prosternum unarmed, mesally emarginate. Prosternum nearly equal in length and breadth. Median length 1.7 times greater than length of femuroid on its ectal side. Paired sulci of tergites deeply impressed. Anterior ventral plates with a deeply impressed median longitudinal sulcus, this becoming shallower toward posterior region and finally disappearing. No ventral pores detected. Anterior spiracles vertically elliptic, the first abruptly much larger than the second; those of middle and posterior regions circular. First legs much smaller than the second. Last ventral plate broad, narrowed caudad (trapeziform); the caudal margin shallowly incurved mesally; sides convex, converging more strongly over posterior part of length than over anterior. Pores of coxæ simple, small, few in number, six or seven arranged in a circular line with mesal two or three covered by last ventral plate. Anal legs somewhat crassate, thickest near middle of length, the last article distally rounded, wholly lacking any trace of claw. Anal pores conspicuous. Pairs of legs in holotype, fifty-one. Length, 30 mm.

Arizona: Flagstaff. One male taken in May, 1929.

SCOLOPENDRA POLYMORPHA Wood

Utah: Fruita and Horse Valley, Wayne County; Henry Mountains, at and near King's ranch. Common.

This species is distributed throughout Utah as far north as Salt Lake County. The specimens from the northern part of

the state are smaller and less brightly colored than those from the south. The Wayne, Garfield County, specimens are large and have the tergites conspicuously banded across the posterior borders as in typical Arizona and California specimens.

Diplopoda

Parajulus tiganus Chamberlin

Utah: Mill Creek and Butterfield canyons, Salt Lake County (August and May, 1929); Fish Lake, Sevier County (September 4 and 6).

Undoubtedly the most abundant member of the genus in the state.

Parajulus paiutus Chamberlin

Utah: Fish Lake, Sevier County; Weber Canyon, Summit County, where it occurs along with the commoner *P. tiganus*.

Previously known from Parowan and Cedar City, Iron County, and Zion National Park, Washington County.

Parajulus sp.

Utah: Henry Mountains, Garfield County.

Specimens of a species of Parajulus were collected in the Henry Mountains at Willow Springs and other points, but the vials containing them have been misplaced or lost. Only one specimen, a not fully mature male is available at this time.

Piedolus Chamberlin, new genus

Related to *Atopetholus* and allied spiroboloid genera of the southeastern United States. It is like *Atopetholus* in having the first three pairs of legs crassate in the male; but the claws are not disproportionately enlarged or hypertrophied, being obviously shorter than the last tarsal joint, the next three pairs of legs less crassate, and all others normal. Unlike *Atopetholus*, it has the coxæ of the third legs with processes much more developed than in the following legs, these processes being chitinous, smooth falcate or subuncate blades. Coxæ of fourth, fifth and sixth legs compressed in the caudo-cephalic direction, and projecting ventrad at ends but little. Collum with lateral ends acute, and with anterior margin incurved on each side opposite level of eye. Anal valves with mesal margins meeting in a groove, not compressed or elevated.

Telopodite of anterior gonopods exceeding the coxal plate, a little produced at mesodistal angle. Posterior gonopods with telopodite furcate or biramous, the branch carrying the duct slender, the other laminate.

Genotype. *Piedolus utus* Chamberlin.

Piedolus utus Chamberlin, new species

Color in general deep brown or almost black, the segments lighter beneath; head and anal segments uniform in color except for a median pale line above clypeal incision; legs and antennæ concolorous with body.

Clypeal foveolæ 5 + 5. Median sulcus extending across vertex and down to level of antennæ where it is furcate, the divergent branches only obscurely impressed. Lower angle of collum on each side a little rounded; anterior border margined from the angle up to level opposite the eye.

Segments transversely constricted or furrowed in front of level of spiracles; smooth, scarcely at all sculptured, the surface caudad of constriction obscurely and very finely punctate. Anal valves inflated, not at all compressed, equaling the last dorsal plate. Last dorsal plate caudally widely rounded; transversely depressed near middle of length.

In the male the slender coxal processes of the third legs curve caudad to or just beyond the coxæ of the fifth legs. Gonopods as represented in the accompanying figure. Number of segments, 44. Length, about 30 mm.; diameter, 3 mm.

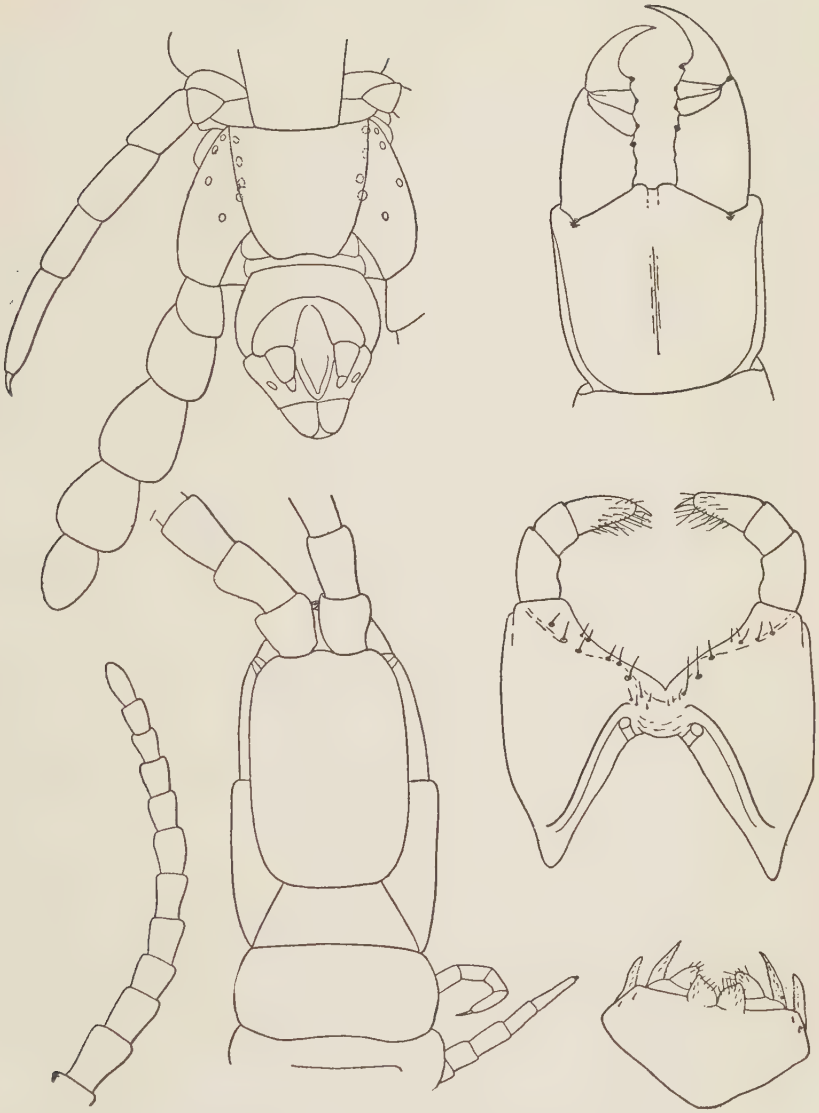
Utah: St. George. One male taken April 3, 1929, by Lowell Woodbury.

Brachydesmus henriensis Chamberlin, new species

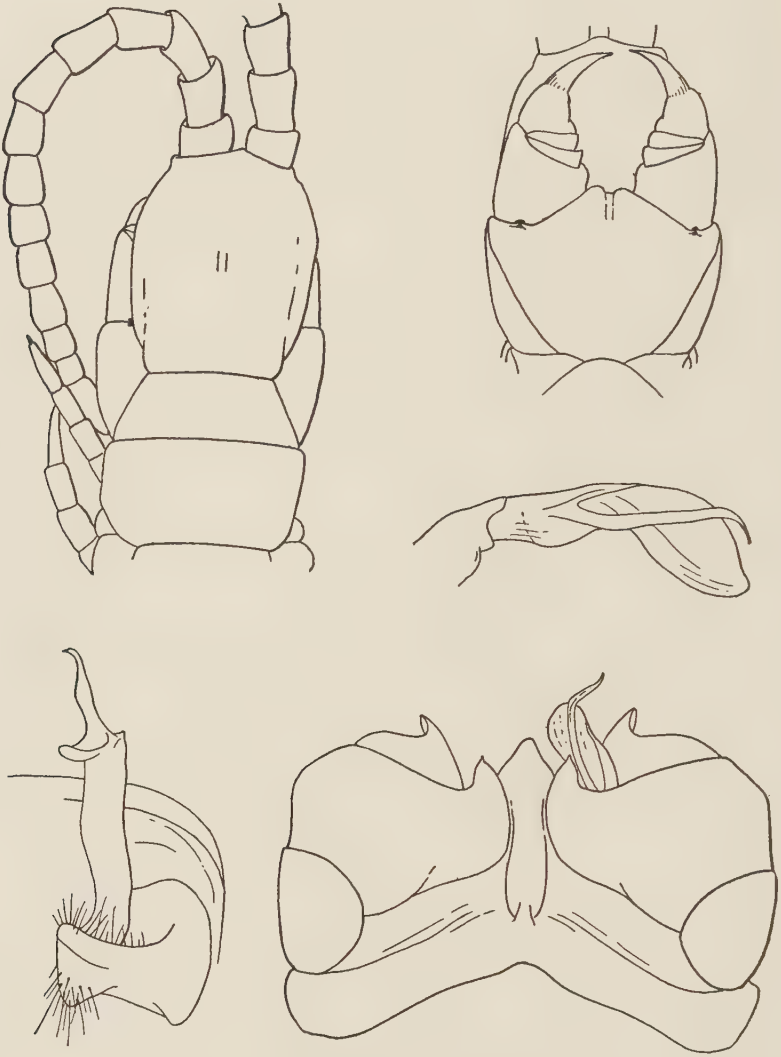
Typically the body is light brown above and over the sides; the venter, including basal joints of legs, lighter, yellowish or sometimes whitish. The head brown above, but in clypeal region and up to or a little above level of antennæ paler, yellowish. Legs light brown, the antennæ, except proximally, darker, the joints sometimes pale at distal ends.

Collum not quite as wide as head inclusive of cardines, and decidedly narrower than the second tergite; lateral and anterior margins together forming an even, subsemicircular curve, this margin with typically eighteen distinct, setigerous teeth.

In the other tergites the keels are nearly horizontal, the lateral ends of the most posterior ones a little upturned. Second tergite obviously wider than the head; keels bent forward; anterior margin of keel smooth; lateral margin with two large, setigerous teeth between a small one at anterior corner and a larger one at posterior corner; caudal margin of keel with two teeth. Keels of subsequent tergites more nearly transverse, those of middle and posterior regions entirely so; all with marginal teeth arranged as in the second. Anterior margins of keels from fourth to seventh with one or two minute serrations proximad of corner tooth. Keels of seventeenth and eighteenth tergites shortened and with caudal angles produced



Navajona miuropus, new species. Top figures: left, caudal end, ventral view (x 62); right, prehensors, ventral view (x 27). Middle figure: second maxillæ (x 62). Bottom figures: right, second maxillæ (x 62); middle, anterior end, dorsal view (x 27); left, last eleven articles of left antenna (x 27).



Top figures: Dorsal view of anterior end and ventral view of prehensors of *Geophilus fruitanus* Chamberlin (x 39). Middle figure: Telopodite of left posterior gonopod (x 40) of *Piedolus utus,* new species. Right figure at bottom, gonopods, anterior view (x 32). Left figure at bottom, left gonopod of male, subventral view, of *Brachydesmus henriensis,* new species (x 40).

moderately caudad of caudal margin of tergite. Tubercles of the three transverse rows well developed, all setigerous.

Gonopods of male conspicuously exposed. The telopodite bent forward in the excavation and then ventrocephalad between bases of legs of the preceding body segment. Basal segment of each gonopod swollen into a thick, rounded rampart ectad of excavation in which telopodite arises. Telopodite ending distally in a long, slightly sinuous or sigmoidal process which is acute distally, this terminal process with a minute tooth at base on subectal side and with a thin, rounded lamina on mesal side as shown in the accompanying figure.

Length, 12 mm.; width, 1.5 mm. (male holotype).

Utah: Henry Mountains, above King's ranch. Taken among rocks at level of the quaking aspens on slopes of Mount Ellen. Many specimens.

SPIROSTREPHON UTORUM Chamberlin

Utah: **St. George, Washington County,** one female taken April 3, 1929, by Lowell Woodbury.

Previously known from Emery, Wayne, and San Juan counties.

UNDERWOODIA TIDA Chamberlin

Utah: Butterfield Canyon, Oquirrh Mountains, Salt Lake County (May, 1929).

Many specimens, of which all but one are females. A similar disproportion of the sexes has been noted in other species of this genus. Described originally from Loga, Cache County.

TWO CORRECTIONS

On page 15 of this volume the name *Diceratothrips brevitubus* Moulton, n. sp., should read **Trybomia brevitubus** Moulton, n. sp.

On page 57 of this volume the Miscellaneous Studies in the Coleoptera, by Dr. Blaisdell, should have been Number Four instead of Number Three.

The Correct Names of Certain Species of North American Meloe (Meloidæ, Coleoptrea)

Soon after the appearance of my paper,[1] dealing with the species of *Meloe* in this country, Mr. K. G. Blair of the British Museum informed me that we in America had apparently never properly understood certain of the species described by Leach and Kirby in spite of the fact that supposedly both LeConte and Horn had examined the types which are now in the British Museum. Mr. Blair very kindly sent me typical specimens compared with these types as well as carefully compared some of my specimens with the same. As a result of these careful comparisons we are forced to make the following changes in regard to the species listed in my work:

Meloe americanus Leach. (not *americanus* of American authors) = *Meloe moerens* LeConte, the latter an absolute synonym of the former.

Meloe impressus Kirby = *Meloe americanus* of my work and of American authors generally. The type of *impressus* is somewhat abnormal, having a very short prothorax; but it otherwise agrees. Inasmuch as this species is a very variable one, particularly as regards the proportions of the prothorax, both Mr. Blair and I agree that it is better to retain the name *impressus* for all of the variable forms of the more Eastern species rather than to limit the name to an abnormal form and coin a new subspecific name for the usual forms with the prothorax more elongate. My subspecies *occidentalis* will, therefore, rank as a subspecies of *impressus* Kirby.

Meloe niger Kirby = *Meloe impressus* of my work and of American authors generally. Mr. Blair found that the *niger* and *impressus* of Kirby were as indicated above, two very distinct species, not mere phases of one species as we have believed in this country.—Edwin V. Van Dyke.

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1 A reclassification of the genera of North American Meloidal (Coleoptera) and a revision of the genera and species placed in the tribe Meloini found in America north of Mexico, together with descriptions of new species. Univ. Calif. Publ. Entom., Vol. IV, No. 12, pp. 395-474, pl. 15-19 (1928).

THREE NEW DOLICHOPIDS FROM CALIFORNIA AND COLORADO (DIPTERA)

BY M. C. VAN DUZEE

Buffalo, New York

Pelastoneurus latifacies Van Duzee, new species

Male. Length, 5 mm. Face very wide, silvery white, the suture near the middle, upper part concave, lower part quite bulging and cut off straight at lower edge; palpi black, covered with white pollen; front velvety black along the orbits, opaque reddish brown in middle, which color extends to the orbits at vertex; antennæ and orbital cilia wholly black, arista feathered with rather stout, short hairs, which are about as long as longest hairs on second antennal joint.

Thorax and abdomen black, latter with coppery reflections and spots of white pollen on sides of segments, last segment wholly white pollinose; thorax with large triangles of white pollen at the sutures, but this pollen is not silvery; hypopygium large, black, its lamellæ black, somewhat oval, fringed with long hairs, the lowest of the inner appendages are a pair of rather slender, black, somewhat clavate organs with several long, stiff hairs at tip.

Coxæ, femora and tibiæ black, knees narrowly yellow; fore and middle femora with a row of black hairs below, those on anterior pair half, on middle ones one-fourth as long as width of femora; fore tarsi black above with white hairs, below yellow for half or more of their thickness; middle and hind tarsi wholly black; fore tibiæ and tarsi of equal length, joints of fore tarsi as 25, 16, 14, 12, 9; first two joints of hind tarsi as 43, 52. Calypters and halteres yellow, cilia of former black.

Wings almost hyaline, cross-vein and last section of fourth vein a little clouded with brown, the latter bent at or a little beyond basal third; apical part straight; third vein a very little bent back at tip; costa not enlarged.

Female. Face very wide, opaque golden brown, lower part narrowly white pollinose along the orbits, suture above the middle; front metallic, partly shining; thorax black with slight purple reflections; abdomen shining green with coppery reflections on posterior part of segments; all coxæ black; femora yellow, more or less blackened at extreme base, middle ones

with a row of black hairs below; middle and hind tibiæ sharply black at base; fore tarsi colored, as in the male; wings about as in the male but the brown cloud on fourth vein forms a small, indistinct spot at the bend; last section of fifth vein one and a half times as long as cross-vein.

Described from one pair, taken by the author, in 1926, holotype, male, at Lower Lake near Clear Lake, California, May 11; allotype, female, at Konocti Bay, Clear Lake, May 10.

Types in the author's collection.

Dolichopus subcostatus Van Duzee, new species

Male. Length, 5.5 mm. Face wide, white, very slightly yellowish, especially above; front shining blue green; antennæ yellow, third joint about as long as wide, largely blackish, obtusely pointed; lower orbital cilia yellowish, the black cilia descending, almost one-third of the eye height.

Dorsum of thorax green with blue reflections and with a median coppery vitta, also a little coppery along the sides. Abdomen coppery with green reflections on the sides; hypopygium black, its lamellæ rather large, somewhat oval, white with apical margin narrowly black, jagged and bristly.

Fore coxæ, femora and tibiæ wholly yellow; middle and hind coxæ yellow, blackened on outer surface; hind femora ciliated on middle half of lower posterior edge with yellow hairs, which are longer than width of femora; fore tarsi yellow, black from middle of third joint, third and fourth joints fringed above with long black hairs; middle and hind tarsi black from tip of first joint, middle basitarsi with a large bristle above at apical third. Calypters and halteres yellow, cilia of former black.

Wings grayish; costa deep black, distinctly thickened from just before the tip of first vein, gradually tapering to normal size, but rather strong to its tip; last section of fourth vein bent before its middle at a right angle, with a stump vein at the bend; upper bend also a right angle and scarcely at all rounded, third vein considerably bent back at tip, so as to approach fourth; last section of fifth vein a little longer than the cross-vein; anal angle of wing prominent.

Described from one male, taken by E. P. Van Duzee, June 17, 1929, at Big Pine, Inyo County, California. Holotype No. 2622, California Academy of Sciences.

This species belongs to the closely related group which includes *longipennis* Loew, *sarotes* Loew, *cuprinus* Wiederman, and *absonus* Van Duzee, Cole and Aldrich, all of which have the fore tarsi formed nearly alike, the last two also have the venation almost like this form; the fore tarsi are formed almost as in *cuprinus*. It differs from all these species in having the costa gradually tapering from the thickest part which is at tip of first vein, and, although the costa is fully as much thickened as in any of the other forms, it leaves the front line of costa straight; in the others where the costa is thickened it is a little bulged outward at the thickened part.

Dolichopus nigroapicalis Van Duzee, new species

Male. Length, 4 mm. Face rather narrow, its sides parallel, face and palpi covered with yellow pollen, which is rather pale; front shining green with bronze reflections; antennæ yellow, rather long, third joint a little blackened above (the tip broken off in type); arista dorsal, black; lower orbital cilia yellow, the bristles blunt at tip.

Dorsum of thorax dark green, almost blackish, with coppery reflections, shining, a little dull when viewed obliquely. Abdomen shining, coppery, hairs black, sides with very little pollen; hypopygium black, of normal size, lamellæ oval, about as long as wide, with a short petiole at base; white with a black border; bristly and jagged at outer corner.

Fore coxæ wholly yellow with small black hairs; middle and hind coxæ black with narrow yellow tips; femora and tibiæ yellow, posterior tibiæ very narrowly but quite sharply black at tip; middle tibiæ very slender, base normal, upper surface with silvery pollen and with a narrow black line which does not reach the base and is wholly concealed by the silvery pollen when viewed obliquely (tip of the only middle tibia left on type is broken off); one bristle on upper anterior surface near base; fore tibiæ with one bristle on lower posterior surface near basal third and two large ones on upper anterior surface of basal third; hind tibiæ narrowly black at extreme tip, the black quite sharply defined, with one bristle at apical fourth of lower anterior surface; fore tarsi black from tip of first joint, hind ones wholly black; joints of fore tarsi as 37, 18, 14, 8, 7; first four joints of hind tarsi as 47, 40, 28, 18. Calypters yellow,

their cilia mostly black, but many of the hairs yellow; halteres yellow.

Wings grayish; veins dark brown, yellow at root of wing; third vein a little bent back at tip; last section of fourth vein bent quite sharply before its middle; last section of fifth vein twice as long as cross-vein.

Female. Face wide, gray pollinose; palpi yellow with black hair and one black bristle; antennæ yellow, third joint mostly blackish, about as long as wide, obtusely pointed; anterior and posterior tibiæ about as in the male; middle tibiæ normal, their tips slightly brownish, a large bristle near apical fourth of lower anterior surface and several bristles above; middle tarsi wholly black; venation of wings and body color about as in the male.

Described from one pair, taken by E. C. Van Dyke, July 13 and 14, 1926, at Longs Peak Inn, Colorado, 9000 feet elevation. Holotype, male, No. 2623, allotype, female, No. 2624, California Academy of Sciences.

Doctor Herbert J. Pack

In the death of Doctor Herbert J. Pack, which occurred at Logan, Utah, January 5, 1930, the biologists of the State of Utah lost an energetic fellow worker and a genial friend. Born in 1893, he received his bachelor's degree at the Utah State Agricultural College in 1912, and his master's degree from the same institution in 1923. Following this, he attended Cornell University for two years, receiving the degree of Doctor of Philosophy in 1925. He returned to the Utah Agricultural Experiment Station as associate entomologist, and in 1926 was appointed station entomologist. For many years his principal interest was herpetology, in which field he published a number of papers. At the time of his death he was endeavoring to complete the work on several problems, the material for which was almost ready for publication, and plans are being made for the work to be finished and published at a later date. Doctor Pack was a member of the American Association of Economic Entomologists, Entomological Society of America, American Academy of Sciences, and the Utah Academy of Sciences.

OCCURRENCE OF THE WEEVIL PHYRDENUS MURICEUS (GERM.) IN ARIZONA

BY HAROLD R. BRISLEY

Judging from the results of an infestation of this weevil in a field of eggplants (*Solanum melongena* L.) during the summer of 1929, I am confident that, should the species become established here, its ravages would prevent the growing of eggplant on a commercial scale, unless adequate control measures could be devised.

Specimens which I collected were sent to Dr. E. C. Van Dyke and Dr. H. C. Fall for identification. Through their efforts it was determined as the species mentioned above. Furthermore Dr. Van Dyke advises that this is the first report of the occurrence of the species in Arizona since Casey described it in 1892, under the name *Phyrdenus bullatus*. Later this was placed by Champion as a synonym of *Phyrdenus muriceus* (Germ.). Probably the only other specimens now in collections in this country are the Casey types. A somewhat extended description of the habits and results produced by the species should be of value in enabling other entomologists and field men to recognize this species when encountered.

The field in which I discovered the infestation is located on the banks of Oak Creek, a well-known trout stream in central Arizona, near the Page Fish Hatchery. About a dozen rows of eggplants were growing in a truck garden area. Adjacent to the eggplants were growing tomatoes, peppers, turnips, and several other varieties of truck crops. A close search revealed that none of the other varieties were infested, nor was the weed thorn apple (*Datura meteloides*), which is a close botanical relative of the eggplant and harbors many of the common eggplant insects.

August 2 was the first time that I saw the plot in question. The owner advised that the plants had been growing in a perfectly normal manner until about ten days prior to my visit. This statement was borne out by the size and general thrift of the planting. On this day about 25 per cent of the plants showed definite wilting and, after a month had elapsed, 75 per cent of the planting had been rendered worthless. On August 2 all stages of the insect transformation were present. The eggs

were found in the soil near the underground stem and close to the ground line. The white grubs were feeding on the roots to a depth of three inches, and many were partly buried in the tissue of the underground stems. The pupæ were in small earthen cells which would readily break open when the plant was uprooted. The adults are hard to find but were finally discovered at the base of the plants, feeding on the stems at the ground line. Their color is so like that of the earth that I passed over many of them without notice until I discovered that the small pebbles I was looking at were in reality the adult insects. The adults do not feed on the leaves, fruit, or stems above ground, as is usually the case with weevils whose young are root feeders, but limit their activities to the stem at the ground line. Their feeding punctures are relatively small and would probably cause little injury if not accompanied by the much more severe injury caused by the young. The effect on the plant is much more severe than in the case of the Jimson weed borer (*Trichobaris compacta* Casey), which is often found boring in the stems of eggplant in this locality. In the case of Phyrdenus the plants have more the appearance of gopher injury. It takes only about a week from the time that wilting is first apparent for the top to become dead and dry.

Observations would indicate that so far the infestation is very limited in extent. About one hundred yards distant was a field of about an acre of eggplants. I watched this area closely throughout the season and found no Phyrdenus infestation, though later in the year many plants were rendered worthless by the borings of *Trichobaris compacta.*

Phyrdenus appears to have only one brood each year, for on September 14 all larvæ, pupæ and live adults, had disappeared. The few adults found at the base of the plants were dead. No live adults were in evidence during the remainder of the season.

NOTES ON THE GENUS DIODYRHYNCHUS SCH. WITH A DESCRIPTION OF A NEW SPECIES (COLEOPTERA)

BY J. O. MARTIN
Berkeley, California

The genus Diodyrhynchus of Schœnherr[1] has remained since 1880[2] with but a single North American species (*byturoides* Lec.) which was described from the Sierra Nevada of California. From an examination of a series of nine males and eleven females of *byturoides,* all taken in the Sierras, and in the collection of the California Academy of Sciences, I record the following observations on the sexual characters in the above species. In the males the prothorax is noticeably narrower than the base of the elytra, while in the females it is fully as wide. The beak of the female is more curved and stouter than that of the male. The male thorax is widest at about the middle, while that of the female is widest at about the basal third and not at base as stated by Dr. Le Conte. The underside of the body of the females is piceous with the exception of the anal segment, while all of the males are testaceous above and below. In some instances the females are, with the exception of the prothorax, entirely black, but I have seen no males thus colored. The most important sexual difference is to be noted on the third and fourth abdominal segments on each of which are two large, shallow punctures or pits, one on each side of the median line, and from which extends a pointed brush of white hairs.

This genus may at once be separated from Rhynomacer by the way the beak joins the front. In Rhynomacer the front rises from the beak at a much greater angle. In Diodyrhynchus the front is in almost the same plane and only a slight sinuation marks the separation.

In the L. S. Slevin collection, recently presented to the Academy, I find a series of twenty-four specimens evidently belonging to this genus and representing an undescribed species. Mr. Slevin informs me that they were taken on the beach at Carmel, California, where they were washed up by the waves in company with numerous specimens of a species of Rhyno-

1 Gen. Sp. Curc., 1833, Tome I, p. 240.
2 Trans. Am. Ent. Soc., VII, 1880, p. 215.

macer. A majority of the specimens were taken in February, which is about the normal season for the Monterey pines to be in blossom, and I suspect that this species, like Rhynomacer, is a pine-blossom feeder and in flight falls into the water.

Diodyrhynchus slevini Martin, sp. nov.

Elongate oblong-oval, convex, testaceous throughout except that in the female the thoracic and abdominal segments are piceous. Head obscurely, coarsely punctate with rather coarse long, white decumbent hairs on the front between the eyes which grow shorter, finer and more scattered toward the vertex; the punctuation of the beak is more definite, hairy on the sides but not on the upper surface which is flat and without grooves or carina, the beak is more quadrate in cross section than in *byturoides* and, like that species, the female beak is more curved. Eyes black, prominent, finely faceted. Prothorax rather coarsely and moderately punctate, less so on the disk, with long decumbent white hairs on the sides, becoming finer and more scattered toward the base; narrower than base of elytra in the male but fully as wide in the female, widest just before the middle in the male and at basal third in female, in which sex there is a slight longitudinal depression above the median line. On the female prothorax behind the eyes is an elevated area which extends downward along the border with blunt tooth-like granulations which vary considerably in size and shape in different specimens, the toothed portion being immediately behind the eyes. Elytra more densely punctate than the prothorax with long, white decumbent hairs on the sides becoming shorter and finer toward the suture; in the female there is a shallow, curved, oblique depression starting near the humeral angle and extending beyond basal third to the suture where it is broadest and deepest; this depression is present but less pronounced in the males. Sternum, abdomen and legs with sparse white decumbent hairs.

On the fourth abdominal segment of the male on the median line is a single large shallow pit or puncture with a pointed brush of white hairs, which is entirely lacking in the female. Length, 3 to 4 mm.

Type: Male, No. 2625, and allotype, female, No. 2626, in the collection of the California Academy of Sciences.

Diodyrhynchus slevini differs from *byturiodes* Lec. by its smaller size, its longer, coarser and more irregular hairs, as well as by the single abdominal brush in the male, and the roughened prothoracic area behind the eyes in the female which are not present in *byturoides*.

I take pleasure in dedicating this species to Mr. L. S. Slevin, whose careful collecting has done so much to make known the interesting insect fauna of the Monterey peninsula.

TWO NEW SPECIES OF VANDUZEEINA FROM CALIFORNIA (SCUTELLERIDÆ, HEMIPT.)

BY R. L. USINGER

Oakland, California

The material used in the preparation of this paper was kindly loaned to me by Mr. E. P. Van Duzee from the collection of the California Academy of Sciences except for two specimens which were submitted to me for determination by Mr. A. T. McClay. Mr. Van Duzee has very kindly read the manuscript and made several valuable suggestions.

Vanduzeeina ænescens Usinger, n. sp.

Near *balli* Van D., but covered with a long brown pubescence; head distinctly bronzed; pronotum narrower with the sides more nearly parallel and rectilinear. Length, 5 to 6 mm.

Head more narrowed anteriorly than in *balli*; tylus tumid, surpassing the juga, which are broad at apex. Pronotum transverse; the ratio of the length to the width three to five; one-half as long as wide in *balli*; margins more nearly parallel; anterior margin rectilinear; sides depressed with the margins sharply carinate and rectilinear; the anterior angles forming almost a right angle; transverse impression deep, slightly behind the middle. Scutellum with the apex regularly rounded, marked with a more or less distinct subapical triangular fuscopunctate pale spot, its sides margined with black; a more or less distinct, slightly oblique, vitta either side of the disk bisecting a fuscopunctate paler area. Connexivum black with a linear pale spot behind each incisure. Vestiture of long brown hairs and a sparse shorter cinereous pubescence, becoming shorter on the venter. Dorsum evenly and closely punctate; a median pale carinate line on the scutellum, more or less distinct, which becomes concolorous anteriorly. Femora slightly thicker than in *balli* and covered with brown pubescence. Rostrum almost attaining hind margin of second ventral segment; apical two joints thickened and darker as in *balli*. Antennæ with the apical two joints thicker in the male than in *balli*.

Color æneous-black, more bronzed on the head, with lighter markings on the scutellum. Venter black; coxæ, apices of the tibiæ, and the tarsi fuscotestaceous. Described from one male and three females.

Holotype, male, No. 2627, Mus. Calif. Acad. Sciences, collected by Dr. E. C. Van Dyke, June 20, 1929, at Potwisha,

Sequoia National Park, California, and allotype, female, No. 2628, Mus. Calif. Acad. Sciences, collected by E. C. Van Dyke, June 13, 1929, in Sequoia National Park. Paratypes, two females, taken by Mr. A. T. McClay in Sequoia National Park, June 13 and 18, 1929, in the collection of the author.

Vanduzeeina slevini Usinger, n. sp.

Nearer *œnescens* Usinger than *balli* Van D. The vestiture long, fuscotestaceous, as in *œnescens*; pronotum broad with the margins broadly flattened as in *balli,* but narrower behind with the margins more nearly rectilinear. Length, 6.5 mm.

Female. Head more narrowed apically than in *balli*; tylus scarcely surpassing juga; eyes vertical, narrowed. Pronotum transverse, narrower behind than in *balli*; margins but feebly arcuated. Legs thicker than in *œnescens.* Rostrum reaching the posterior coxæ with the apical two joints thickened. Penultimate segment of antennæ slightly widened apically; subfusiform in *balli*; third and fourth segments subequal, fourth longer than third in *balli.*

Described from one female specimen taken by Mr. L. S. Slevin of Carmel, California, after whom the species is named.

Holotype, female, No. 2629, Mus. Calif. Acad. Sciences, collected by L. S. Slevin at Carmel, Monterey County, California, April 30, 1916.

Dr. E. C. Van Dyke took a specimen, which may be the male of this species, at Carmel, California, on May 21, 1911. In most characters it agrees with the female of *slevini* but has the tylus more distinctly surpassing the juga; eyes wider than in the female *slevini* but narrower than in the male of *balli;* legs thicker and with longer pubescence than in *balli;* color lighter on the dorsum; head and anterior portion of pronotum black; posterior portion of pronotum becoming light brown medianly; scutellum light brown with a triangular spot at base and area near the basal angles black.

Key to the Species of Vanduzeeina Schout.

Larger, more than 6 mm. Vestiture very short. Head longer, slightly oblique, with the sides more parallel..... 1

Smaller, 6 mm. or less. Vestiture longer. Head short, vertical, narrowed apically..... 2

1. Smaller, 6-7 mm. The transverse median pronotal impression distinct. Apex of scutellum, in female, with a large oblong pale spot margined with black.....*californica* Van D.

—. Larger, 7.5-8 mm. The transverse median pronotal impression very feeble. Apex of scutellum, in female, with a smaller and less distinct pale spot not outlined with black..... *borealis* Van D.

2. Pronotum narrow; sides depressed with the margins sharply carinate and rectilinear. Head produced, bronzed. Scutellum with a more or less distinct, slightly oblique black vitta either side of the disk..... *ænescens* n. sp.

—. Pronotum with margins broadly flattened. Head shorter and broader at base with the apex broadly rounded..... 3

3. Vestiture short. Connexivum alternated with black and pale. Pronotum broad behind; margins arcuate..... *balli* Van D.

—. Vestiture long. Connexivum very feebly marked with lighter color behind each incisure. Margins of pronotum more nearly parallel; rectilinear, or very slightly arcuated..... *slevini* n. sp.

RECORD OF AN INSECT MIGRATION IN THE ARKANSAS VALLEY, COLORADO

BY WALTER CARTER

United States Bureau of Entomology

During a visit to Rocky Ford, Colorado, on the twenty-first day of September, 1927, the attention of the writer was directed to the fact that the sidewalks and curbings along the street were covered with a layer of dead insects. Inquiry elicited the information that on the night of the 17th the insects had flown to the lights of the town in such numbers as to cause the closing of business houses and even interference with automobile travel.

In order to obtain data on the species represented in the flight, a large cigar box full of the insects was collected from the curbing. Some idea of the numbers of insects present can be obtained from the fact that the collection was made by simply picking up a page of a magazine which happened to be lying on the curb and sliding the insects on it into the box.

A sample for determination was obtained from the collection in the following manner: The insects were spread thinly over a rectangular sheet of paper. A straight edge was then placed diagonally across the rectangle and half the layer swept off. This was repeated twice and the portion remaining was taken

as the sample, and the species contained therein were identified by W. L. McAtee, United States Biological Survey (Hemiptera), and E. A. Chapin, United States Bureau of Entomology (Coleoptera), as given in the list which follows. C. T. Greene of the United States Bureau of Entomology reported on the Diptera.

List of species found in sample, with number of specimens of each.

COLEOPTERA

Carabidæ, *Stenolophus conjunctus* Say (1); Hydrophilidæ, *Tropisternus* sp. (1); Phalacridæ, *Phalacrus seriatus* Lec. (2); Chrysomelidæ, *Haltica foliacea* Lec. (2); Curculionidæ, *Anthonomus squamosus* Lec. (2).

DIPTERA

Specimens too badly damaged for determination (17).

HEMIPTERA

Pentatomidæ, *Thyanta custator* Fabr. (1); Coreidæ, *Harmostes reflexulus* Say (27), *Corizus viridicatus* Uhl. (1), *Corisus lateralis* Say (2); Lygæidæ, *Lygæus lateralis* Dall. (8), *Nysius californicus* Stål (503), *Geocoris bullatus* Say (13); Nabidæ, *Nabis ferus* Linn. (9); Miridæ, *Lygus elisus* Van D. (2), *Orthotylus* sp. (3); Cicadellidæ, *Xerophlœa viridis* Fabr. (2271), *Euscelis exitiosus* Uhl. (682), *Eugnathodus abdominalis* Van D. (141); Fulgoridæ, *Liburnia* sp. (3).

The one species *Xerophlœa viridis* Fab. predominates over all other species combined, but two other leafhoppers, *Euscelis exitiosus* Uhl. and *Eugnathodus abdominalis* Van D., contributed large numbers to the sample.

The method of taking the sample undoubtedly eliminated some species which occurred only in very small numbers. The data suggest, however, that the flight was principally by the Hemiptera, and of the 3666 specimens in that group, 3094 were Cicadellidæ.

On the day of the flight an unusual and sudden drop in temperature of between 20 and 30 degrees Fahrenheit was experienced.

THREE NEW LEAFHOPPERS FROM THE SOUTHWEST (HOMOPTERA, CICADELLIDÆ)

BY PAUL B. LAWSON

Lawrence, Kansas[1]

Eupteryx huachucæ Lawson, n. sp.

(Figs. 2-2b)

A pale yellow species strongly marked with red. Length, 2.75-3 mm.

Form: Vertex slightly wider than long, about twice as long at middle as next the eye, quite acutely pointed in female. Pronotum one-third longer than vertex, scarcely twice as wide as long, distinctly widened posteriorly, posterior margin somewhat sinuately concave. Scutellum large, nearly as long as pronotum and nearly twice as wide as long. Elytra very long and parallel margined, greatly exceeding the abdomen; first cross-vein directed somewhat cephalad, apical veins arising from a short common stalk from which the third apical vein soon separates; first and second apical veins having a long common stalk. Venation of hind wing characteristic of the genus.

Genitalia: Last ventral segment of female very long, posterior margin strongly produced to a pointed apex. Last ventral segment of male long, with broadly concave posterior margin; valve hidden; plates long, with slender upturned apices.

Color: Vertex pale yellow with dark narrow marginal band which widens out into a diffused dark area near each eye. Pronotum pale yellow, lateral margins broadly and irregularly brown. Scutellum pale yellow, lateral angles darker. Anterior half of elytra pale yellow marked with red as follows: Irregular spot at base of clavus, smaller irregular spot midway on clavus, a few dots beyond this on clavus and a large spot on band between claval suture and costal plaque which breaks up into smaller spots or dots posteriorly. Posterior half of elytra distinctly fumose, veins for the most part distinctly margined with dark brown or black; tips of sectors and area caudad of dark border of costal plaque, red. Underside practically pale yellow except for two dark dashes on front running mesad from each eye, the dark tips of beak, hind tibiæ, ovipositor, and the dark tarsal claws.

Described from a female and a male, holotype and allotype, respectively, and eight paratypes, all taken by Dr. R. H. Beamer in the **Huachuca Mountains, Arizona,** August 1, 1927.

Types deposited in the Snow entomological collection.

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1 Contribution from the Department of Entomology, University of Kansas.

The male genitalia are not figured because in each of the three males at hand the tip of the abdomen is somewhat distorted.

Joruma minuta Lawson, sp. n.

(Figs. 1-1f)

A very small old-gold species allied to *J. subaurata* but smaller and with distinct genitalia. Length, 2 mm.

Form: Head as wide as pronotum. Vertex one-fourth longer than wide, one-third longer at middle than next the eye, anterior margin broadly rounded, median longitudinal line extending to ocelli, which are large and distinct. Pronotum shorter than vertex, over twice as wide as long, anterior and posterior margins nearly parallel. Scutellum large. Elytra greatly exceeding abdomen; first apical cell apparently small, its basal vein indistinct, other apical cells much larger, slightly increasing in size from the second to the fourth; elytra nearly opaque to tip of clavus beyond which three clear areas appear cephalad of the second to fourth apical cells. Hind wing peculiar in having row of small but stout spines along costal margin, while posterior margin is distinctly serrate, the teeth larger near the base.

Genitalia: Last ventral segment of female with large and deep median incision which bears a small basal lobe; ovipositor distinctly exceeding pygofer. Last ventral segment of male with posterior margin strongly and widely concave; valve hidden; plates quite long, tapering gradually to just past middle, then more suddenly constricted and produced to slender apices which about equal the pygofer.

Color: Old gold, tinged on vertex and pronotum with brownish; elytra golden yellow for over half their length, then smoky hyaline in apical cells and in three cell-like areas cephalad of second to fourth apical cells. Front golden brown, rest of underside more yellowish. Dorsum of abdomen dark brown.

Described from a male and a female, holotype and allotype, respectively, and two female paratypes, taken by Dr. R. H. Beamer, August 3, 1928, in **Cameron County, Texas.**

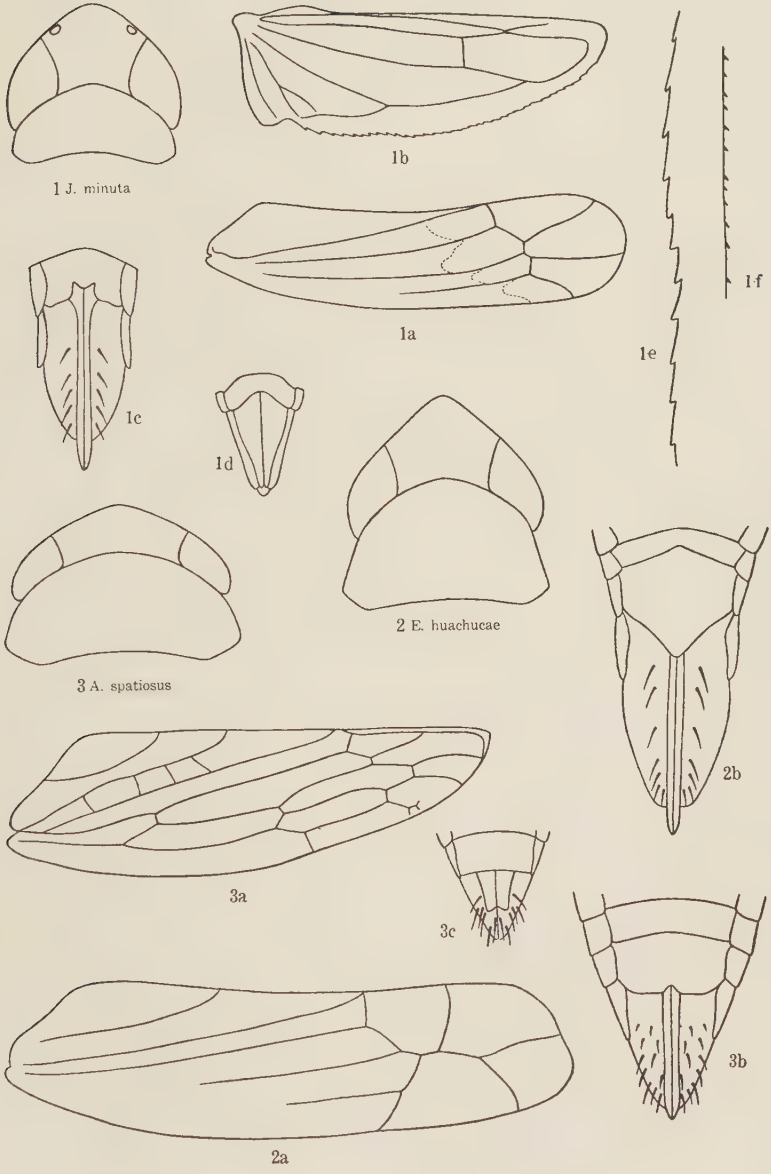
Types deposited in Snow entomological collection.

Figure 1e shows the nature of the serrated posterior margin of the hind wing under high power, and figure 1f shows the spines on the costal margin highly magnified.

Acinopterus spatiosus Lawson, sp. n.

(Figs. 3-3b)

A yellowish-brown robust species allied to *A. angulatus* but more robust and lighter. Length, 5 to 6 mm.


1 J. minuta
1b
1a
1c
1d
1e
1f
2 E. huachucae
3 A. spatiosus
2b
3a
3c
3b
2a

Form: Head slightly narrower than pronotum. Vertex two and one-half times as wide as long, one-third longer at middle than next the eye, anterior margin broadly rounded. Pronotum a little over twice as long as vertex, a little over twice as wide as long, anterior and posterior margins nearly parallel, humeral margins slightly longer than lateral, disk and posterior third transversely wrinkled. Scutellum small. Elytra with costal margin straight clear to tip forming sharply acute apices which are usually flaring; several cross-veins between first and second anal veins.

Genitalia: Last ventral segment of female much as in *A. angulatus* but with lateral angles not as prominent; posterior margin nearly truncate, with definite median notch and with definite lateral angles which are, however, broadly rounded. Last ventral segment of male half longer than preceding; valve hidden; plates longer than in *A. angulatus* and more rounded apically.

Color: Light or yellowish brown; impressed line of scutellum dark; veins of elytra, especially apical ones, with smoky margins, veins on clavus light, claval suture darker, apical cell dark. Eyes dark brown. Underside yellowish brown; a brown dash on either side of median notch of last ventral segment of female. Dorsum of abdomen frequently dark and legs sometimes spotted with brown.

Described from a male and a female, holotype and allotype, respectively, and a series of female paratypes, all from **Brazoria County, Texas.** Taken August 10, 1928 by Dr. R. H. Beamer.

Types deposited in Snow entomological collection.

A Buprestid New to the Yosemite

One of the most characteristic trees on the floor of the Yosemite Valley is the black cottonwood, *Populus trichocarpa* Hook. Common in the ridges of the bark on the trunks of many of these trees are the oval emergence holes of a moderately large flathead borer. In the bark beneath each hole is a dark winding mine made by the larva. The mine winds through the outer bark and down to the cambium, but does not appear to cause any particular damage to the tree. Most of the trees appear perfectly healthy, although the work in the bark indicates that generations of the insects have developed in it. The species is *Poecilonota montanus* Chamberlin, named from specimens collected near Missoula, Montana, by Mr. J. Brunner. Dead beetles were collected from the bark in the Yosemite on July 6, 1927, and live adults crawling on the bark on August 16 of the same year. The live beetles dropped to the ground when touched and were caught without much difficulty.—H. E. Burke.

THE LARVA OF EUBRIANAX EDWARDSI (LEC.) (COLEOPTERA: PSEPHENIDÆ)

BY RICHARD E. BLACKWELDER
Stanford University, California

The larva of *Eubrianax edwardsi* (Le Conte) has been known for a good many years, but all that has been known of it is that it lives in streams and resembles the larvæ of the Parnidæ (Dryopidæ). Le Conte, who received his specimens and his information from Crotch, said: "The larva is subaquatic and resembles in appearance those of Psephenus and Helichus."[1] In his "Insects of Western North America" (1926, p. 404), Essig figures the pupa and adult, and states that the larva lives on rocks in small, fresh running streams, and that pupation takes place in the old larval skin in the water. Böving in April 1929[2] figures the larva and discusses its relation and similarity to the larva of Psephenus. This seems to be the extent of the literature on this very curious larva.

There are certain additional points of interest which are recorded here in company with a detailed drawing of the larva and of some of the unusual structures found upon it. The material for this study was collected by Mr. David Shepherd in Waddell Creek, Santa Cruz County. It was Professor G. F. Ferris who first interested me in this larva, and he has given many suggestions on the study of the material and the preparation of this paper.

The larva is found rather abundantly on the undersurface of stones in places where the water is running fairly rapidly. It is most abundant in the summer.

The larva is flat with the dorsal surface slightly convex. The tergites are rather small, but the pleurites are very much enlarged, extending to the margin from the edge of the pleurites above and back underneath to join the sternites at a point about one-third the distance from the margin to the longitudinal axis. This line between the pleurites and the sternites is rather obscure, and is indicated only by slight folds along the sutures. The pleurites of the prothorax are extended around over the head so that they meet in front and completely cover the head

1 Trans. Amer. Ent. Soc., Vol. V, 1874, p. 58.
2 Bull. Brooklyn Ent. Soc., Vol. XXIV, 1929, p. 59; pl. V, figs. A-F.

above. At the posterior end the pleurites of the ninth abdominal segment meet around the end, covering the retracted tenth segment. It is not quite certain that this designation of the sclerites is correct, there being a possibility that the tergites extend around the margin, and that the pleurites are absent as in many larvæ, but the evident separation of the sclerites along the dorsum, the position of the spiracles (Fig. 1, *A*), and a comparison with other fringed larvæ of this type indicate that the pleurites are enlarged and include the margin. Along the angle of the margin, and therefore on the pleurites, there is a fringe which completely surrounds the larva (Fig. 1, *A*). The fringe is composed of a row of long narrow pedicels, edged with spines; each pedicel bearing a long seta on its distal end (Figs. 1, *H, I*).

The head is small and completely hidden from above. It bears a pair of two-segmented antennæ (Fig. 1, *A*), the labium with its pair of nodule-like palpi, the maxillæ with the two-jointed maxillary palpi (Fig. 2, *B*), and the mandibles (Fig. 2, *C*). The mandibles of some individuals examined were shorter than the one shown and were truncate in front, as if they had been worn down. Böving figures mandibles of this type.

The legs are short and four- or possibly five-segmented, with the coxa, trochanter, femur, and tibia present, and a single terminal claw (Fig. 1, *J*). This may be a true claw or it may possibly be a modified tarsus, which otherwise is entirely absent.

There are only two pairs of spiracles. The anterior ones (Fig. 1, *B*), situated on the proximal anterior corner of the mesopleura, are the mesothoracic spiracles, and the other pair, representing the eighth abdominal spiracles, are on the proximal portion of the eighth abdominal pleurite. On each of the second, third, fourth, and fifth abdominal sternites there is situated a pair of gill groups (Fig. 2, *D*), which are composed of long membranous filaments that become so fine at their extremities as to be invisible. These are evidently functional gills, while it is rather doubtful if the spiracles are used at all.

On the ventral surface are quite a number of setæ of various sizes and shapes (Figs. 1, *C, D*). On the dorsal surface there are some very peculiar scale-like markings (Figs. 1, *E, F, G*),

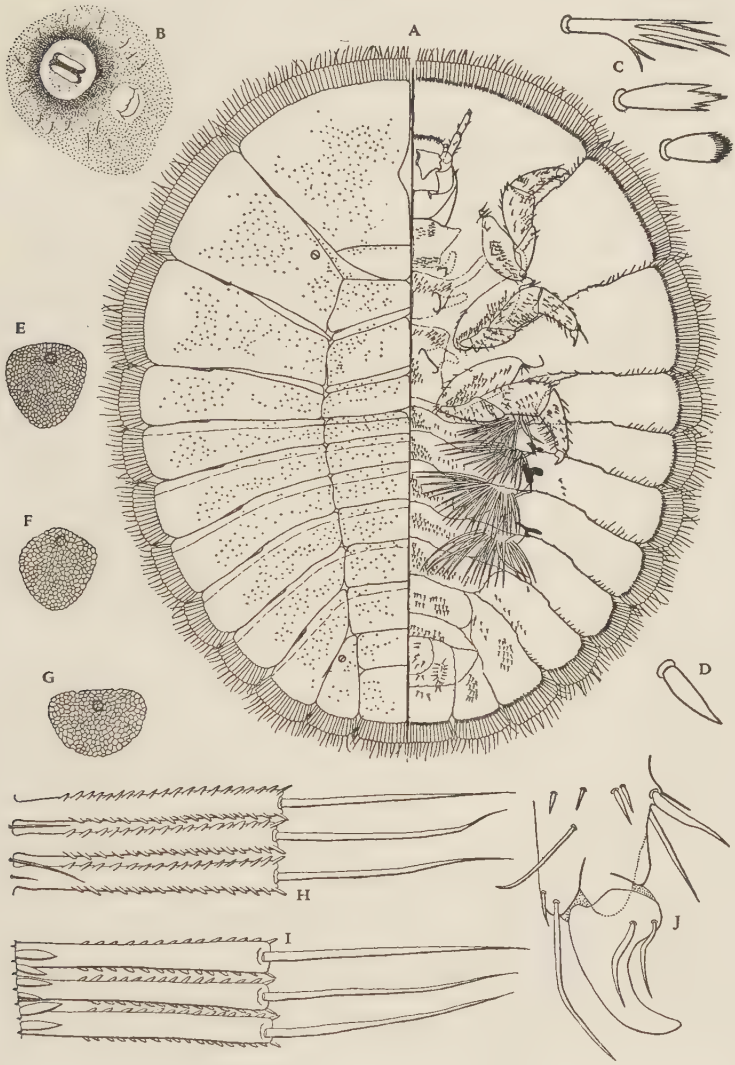


Fig. 1. *Eubrianax edwardsi* (Le Conte), larva: *A*, dorsal and ventral aspects; *B*, thoracic spiracle and surrounding region; *C, D*, types of setæ from ventral side of body; *E, F, G*, scale-like markings of dorsum; *H, I*, portions of marginal fringe from dorsal and ventral aspects respectively; *J*, claw.

which are microscopic in size but which do not appear to be separate scales.

Pupation occurs in the larval skin, except that a portion of the posterior region of the larval skin—probably segments seven, eight, nine, and ten (Fig. 2, *E*)—is replaced by a somewhat similar structure, belonging to the pupa, which corresponds with it, and which bears a different type of marginal fringe (Fig. 2, *F*). The pupal skin itself is membranous, except for this section at the posterior end. Essig's figure of the larva is evidently really only a dorsal view of the pupa, as the fringe in the larva, unlike that in the pupa, extends around the posterior end in an unbroken line.

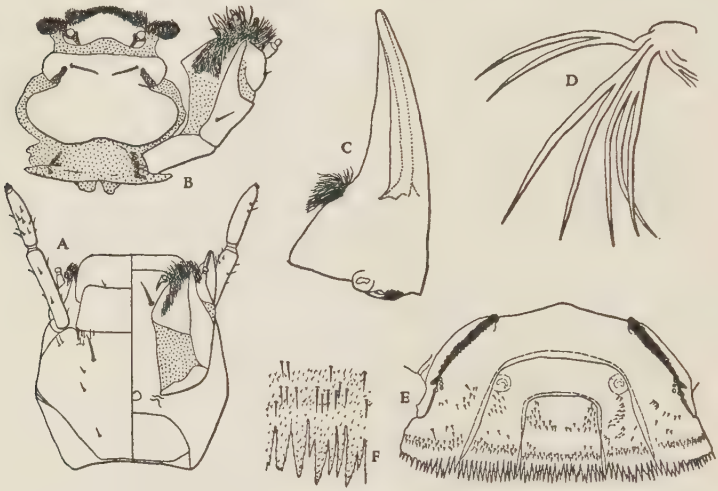


Fig. 2. *Eubrianax edwardsi* (Le Conte): *A*, dorsal and ventral aspects of head of larva; *B*, labium and maxilla of larva; *C*, mandible of larva; *D*, portion of gill of larva; *E*, posterior sclerotic region of pupa; *F*, portion of fringe from this region.

OMISSION FROM OCTOBER NUMBER

(Text to figure on page 66)

"Coffee-pot maker" *Lagoa crispata* Packard. 1. Side view of larva. 2. Dorsal view of larva. 3. Larva drawn up in defensive attitude when disturbed. 4. Cocoon in process of construction viewed from front. 5. Side view of same almost completed. 6. Completed cocoon from which winds and rains remove loose webs shown at the ends. 7. Outline figure of adult showing location of the crinkled tufts on the wings.

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A NEW ABERRATION OF EUCHLOE AUSONIDES

BY M. DOUDOROFF
San Francisco, California

Euchloe ausonides boharti Doudoroff, n. ab.

Differs from *ausonides* in its smaller size, slightly narrower wings, greater heaviness of the dark markings on the superior surface, and the peculiar pattern on the underside of the secondaries.

Primaries: The black bar at the arc is broader, both above and below, than in ***ausonides*** and the green on the underside at the apices is deeper. Secondaries: The greenish gray markings on the underside of the secondaries are greatly enlarged at the expense of the white background, forming a pattern well illustrated by G. F. Ferris in the figure. The veins are bordered with yellow. Expanse: 40 mm.

Holotype, male, in collection of R. M. Bohart, taken at **Berkeley, California,** April 16, 1929. Named after Mr. R. M. Bohart of Berkeley, California, who has kindly loaned it to me for description.

Euchloe ausonides boharti, male, underside, x 2.

THE PAN-PACIFIC ENTOMOLOGIST
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Editorial Comment

We have just received a copy of Mr. W. S. Wright's list of the butterflies of San Diego County, California.[1] This most excellent list records 148 forms with distributional and other data for each, and at the end lists twenty other forms that are likely to occur in that county. Local lists, especially when gotten out by a competent authority as is this, are most valuable and interesting. The San Francisco Bay region needs a similar list and we hope some day we may record its publication.

Fascicle III of a General Catalogue of the Hemiptera,[2] received recently, enumerates the Pyrrhocoridæ of the world. It was compiled by Dr. R. F. Hussey with a bibliography by Elizabeth Sherman and is an excellent piece of work. It has the defect, common to all this series of catalogues, of an alphabetical arrangement of the species, giving no hint as to the relationship of the species. The type used for the various categories could hardly be improved, except, perhaps, that the genus names at the head of the pages might be made a little larger. Why could not the name of each species be followed by a number, in square brackets, indicating the systematic arrangement of the species? The addition of such a number would combine in one list the advantages of both the systematic and alphabetical arrangement of the species. Here for the first time Stål's error in the identification of *Dysdercus mimus* Say is corrected and a new name, *mimulus,* is given the form heretofore known as *mimus.*

Dr. Ralph V. Chamberlin of the University of Utah, Salt Lake City, was a welcome visitor at the Academy recently.

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1 Trans. San Diego Society of Natural History, Vol. VI, No. 1, pp. 1-40, February 28, 1930.

2 General Catalogue of the Hemiptera. Fasc. III. Smith College, Northampton, Massachusetts, 1929.

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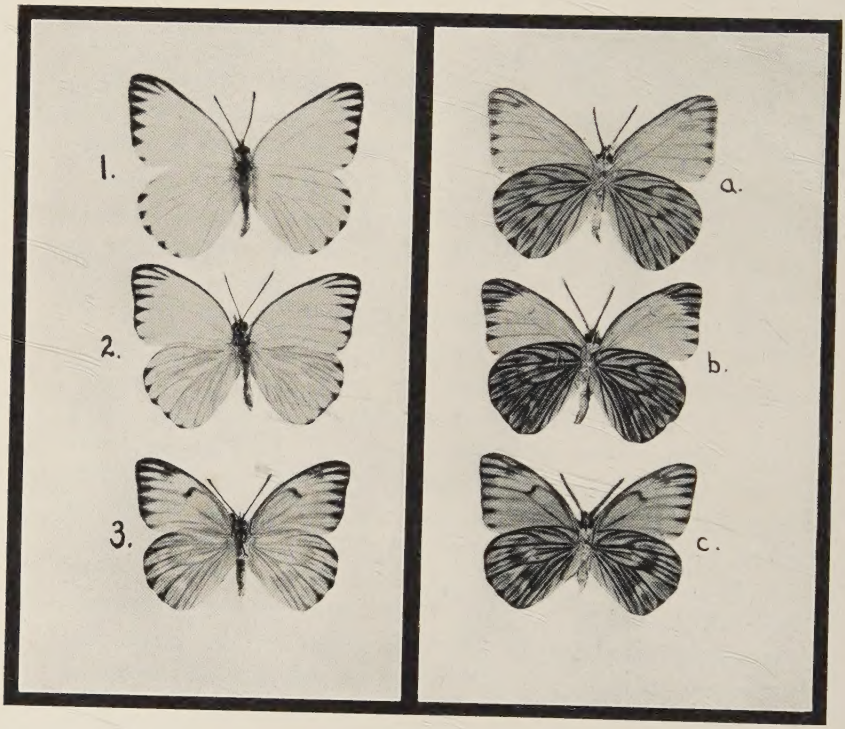

Ascia monuste raza Klots